

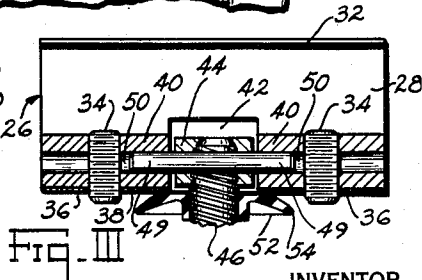
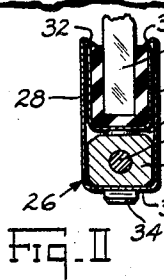
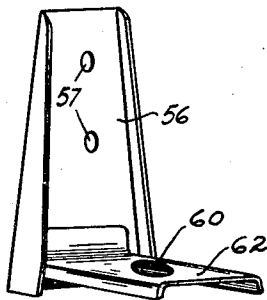
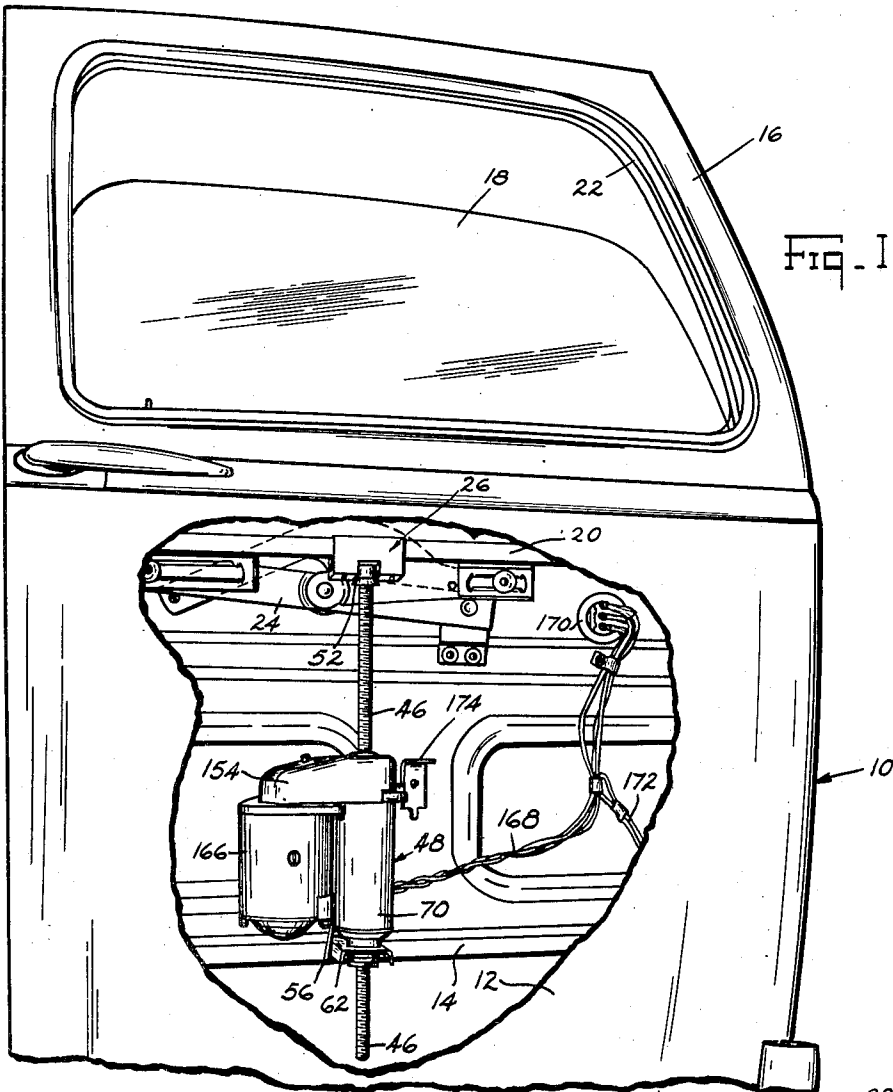
Aug. 18, 1953

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WINDOW LIFTING MECHANISM

2,649,300

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

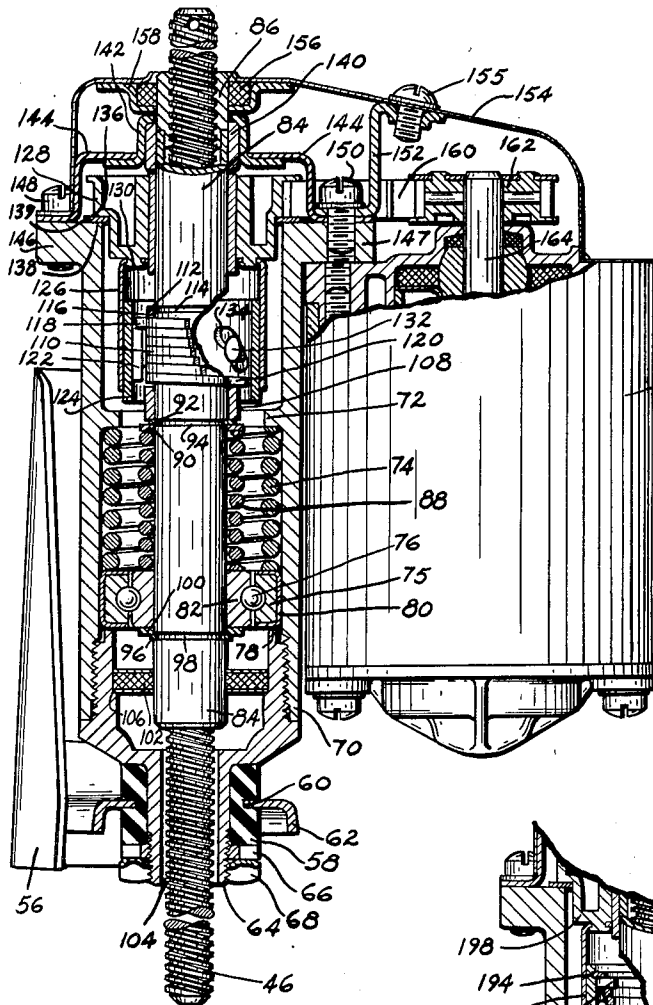


FIG. V

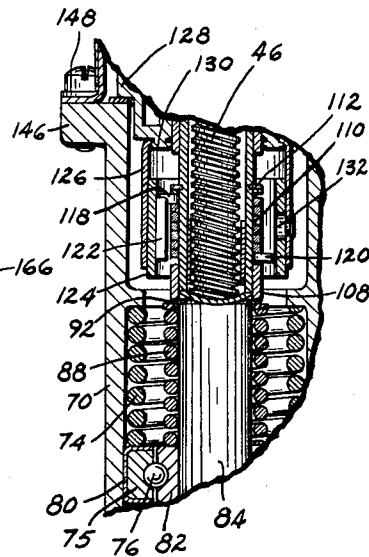


FIG. VI

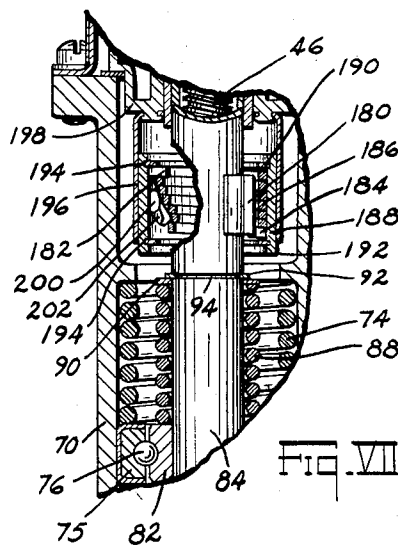


FIG. VII

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WINDOW LIFTING MECHANISM

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The invention relates to power-operated window-actuating mechanisms that may be used for raising and lowering windows located in any structure and finds great utility for positively controlling the position of a window in vehicles such as automobiles.

The invention includes very effective connecting means between a power-transmitting unit and a window-actuating member, which connecting means automatically controls the amount of force transmitted to the window for moving the same from one selected position to another.

The invention contemplates an organization and arrangement of parts that will permit the installation of the entire power-operating mechanism with some window regulators of the manually operable type by improved connections of the mechanism with the window glass and the door frame.

The invention includes a window-actuating mechanism in which a driving member is power-driven to establish a driving connection with the window-actuating member and in which the driving connection therebetween is controlled or interrupted by means responsive to a predetermined window load or resistance to the movement of the window by the actuating member.

The invention embraces a self-contained window-actuating unit including a reversible motor operating through a clutch, a window-moving member to lower or raise the window, the clutch being controlled by the reaction offered to the movement of the window and is so arranged that when said reaction exceeds a predetermined value, the clutch is rendered ineffective, thereby breaking the operating connection between the motor and the window-moving member.

It is one of the objects of the invention to provide a window actuating mechanism, by means of which the window may be held locked against jarring that may be caused by the movement of a vehicle on the roadway. Moreover, by the mechanism of the invention, the window will maintain the position in which it is placed, irrespective of undue vibration and when in closed position the mechanism will prevent movement to open position by unauthorized persons.

Another object of the invention is to provide a very effective and positive means for automatically controlling the amount of force transmitted to a window operating mechanism by an electrically-operated device without stopping the operation of said device, thereby eliminating the use of overload and limit switches.

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Another object of the invention resides in a remotely-controlled, power-operated mechanism for actuating window operating mechanisms or regulators for automobiles which will stop the movement of the window in either direction of operation when the resistance offered to said movement exceeds a predetermined amount which may be of different amounts up or down if desired, it being only necessary for the operator to merely operate a controlling member such as a switch to start and stop said mechanism in the desired direction.

Another object of the invention is to provide a very simple and effective electrically-actuated window regulator adapted to transfer the window from one selected position to another position and vice-versa by only reversing the rotation of its electric motor without the necessity of the usual overload and limit switches as the motor runs essentially under no load when the window reaches either position.

Another object of the invention is to provide an electrically-driven window operating mechanism adapted to move the window and automatically stop said movement when the window reaches the ends of its allowable movement without stopping the operation of its electric driving motor.

Another object of the invention is to provide a self-contained window-actuating unit including a reversible prime mover or electric motor for imparting translatable movement to a window actuator in either direction through a transmission mechanism operable to stop the movement of the window when resistance to movement in one direction is increased but said mechanism is adapted to move the window in the opposite direction by the reversal of the driving motor.

Another object of the invention is to provide a window-actuating device including a reversible rotatable member for imparting translatable movement to a conventional window regulator in either direction by a driving connection with a reversible motor, which connection becomes ineffective on overloads, whereby translatable movement of the window regulator is interrupted until the overload is relieved and thereafter translatable movement of the window regulator can be continued in its former or reverse direction without the conventional motor resetting operation.

Another object of the invention is to provide a power-operated unit for moving a vehicle window between selected positions including means operable when the window reaches a stop or the ends of its allowable movement to exert a pre-

determined force thereagainst and maintain said force to firmly retain the window in said position even after the source of power actuating said unit is disconnected.

Another object of the invention is to provide a power-transmitting unit for a window-actuating member, including connecting means which automatically controls the amount of force transmitted to the window for moving the same from one selected position to another and wherein no adjustment is necessary to compensate for window sizes or tolerances in its manufacture.

Another object of the invention is the provision in a window regulator of a driving connection between a reversible electric motor and a member connected to a window closure for moving the same to and from closed position, said driving connection being effective in either direction of rotation of the motor to provide a free-running period before the driving connection loads the motor to operate the window-moving member.

Another object of the invention is to provide a window regulator in which a member for moving the window is driven by a reversible motor device such as an electric motor through a driving connection or transmission which disconnects the motor device when resistance to movement of the window reaches a predetermined value, allowing the motor to operate freely in the same direction as before and retains the predetermined resistive force on the window, and which upon reversal of the motor device will allow the motor device to operate freely for a short period to attain substantial kinetic energy before the driving connection loads the motor device to overcome the static loaded condition of the window and move the window in the opposite direction.

Another object of the invention is the provision in a window regulator of a driving connection between a reversible electric motor and a member connected to a window for moving the same to and from closed position, said driving connection including a lost motion connection which is effective in either direction of rotation of the motor to provide a free-running period before the driving connection loads the motor to operate the window-moving member.

Another object of the invention is to provide a window regulator in which a driving member is driven by an electric motor to establish a driving connection with a window moving member, and in which the electric motor is provided with a brief, free-running period before operation of the window-moving member takes place.

Another object of the invention is to provide a self-contained power unit for window regulators which is mounted on a resilient member connected to the door or car frame and has the window-moving member directly connected to the window pane, thus simplifying the installation and rendering the same highly adaptable for conventional window closure actuating apparatus of the manually-operated type.

A further object of the invention is to provide universal connection or articulated clip easily attached without special tools to the window pane, thus making possible field or service installations to conventional window regulators and whereby the necessity of special glass channels has been eliminated.

Other objects and advantages of this invention relating to the arrangement, operation and function of the related elements of the structure, to various details of construction, to combinations of parts and to economies of manufacture,

will be apparent to those skilled in the art upon consideration of the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Referring to the drawings:

Fig. I is an elevational view of an automobile door, partly cut away, to show the device incorporating the invention applied thereto;

Fig. II is an elevational view, in section, of a detail of the window connection;

Fig. III is an elevational view, partly in section, taken at right angles to Fig. II;

Fig. IV is a perspective view of the attaching bracket;

Fig. V is an elevational view, partly in section, of the actuating mechanism;

Fig. VI is an elevational view, partly in section, of the mechanism in Fig. V in a different position; and

Fig. VII is an elevational view, partly in section, of a modification of the invention.

Referring to Fig. I, an automotive door 10 is shown, having an outer wall 12 and an inner frame 14, supporting an upper framework 16 enclosing a window opening which may be closed by a sheet of glass 18, resiliently fixed in a cross bar 20 and adapted to be moved substantially vertically in guides 22 formed in the framework 16. To prevent cocking and binding, a parallelogram action 24 is provided, as is well known in the art, and need not be described in further detail. Attached to the cross bar 20, preferably adjacent a central location, a stirrup 26 is provided having sides 28 and 30 each having short flanges 32 on their terminating edges to overhang and grip the cross bar 20 as is best seen in Fig. II, being pulled tightly down by studs 34 extending through apertures 36 in the web 38 of the stirrup and threaded into pivotal blocks 40 positioned against the web 38 and permanently welded thereto to align on their inner ends with a slot 42 formed in the sides 28 and 30 and the web 38. Positioned in the slot 42 between the pivotal blocks 40 is affixed head 44 of a non-rotatable, left-hand-threaded staff or driving member 46, which is adapted to be moved longitudinally by an actuating mechanism 48 to raise and lower the glass 18. The head 44 is provided with a short transverse shaft which forms trunnions 49 fitting into apertures 50 of the pivotal blocks 40. This provides a pivotal connection between the driving member 46 and the cross bar 20, which allows relative movement about the trunnions 49 in a plane transverse to the cross bar 20 and the glass 18. To prevent flow of water drainage from the glass 18 along the driving member or staff 46, a flanged rubber shield 52 is provided to embrace the member 46 to cause the drainage to flow away from the member 46 and drop from its depending peripheral edge 54.

The driving member or staff 46 extends through the actuating mechanism 48 and is of a length so that its longitudinal movement will allow opening and closing of the window glass 18 in the framework 16 without causing disengagement with the mechanism 48, which is resiliently affixed to a bracket 56 attached to the frame 14 of the door by bolts cooperating with apertures 57. The resilient connection is provided by a distortable or resilient member such as a rubber grommet 58 positioned in an aperture 60 of an extension 62 of the bracket 56, as is best seen in

Fig. V, and affixed to a threaded sleeve 64 by nut 66 and lock nut 68. The sleeve 64, in turn, houses the driving member 46 for movement therethrough and is affixed in threaded relation with the housing 70 of the actuating mechanism 48. This resilient connection allows slight relative movement of the whole actuating mechanism 48 about the bracket 56, which holds the mechanism in position in the door and forms an anchor by which the mechanism is enabled to move the driving member 46 along its longitudinal axis to raise and lower the glass 18, as will be described in detail hereinafter.

The housing 70 is tubular in form and is preferably concentric with the axis of the threaded driving member 46 which extends therethrough. Adjacent a central location an internal flange 72 is provided in the housing 70 which forms the anchor of an internally-mounted helical spring 74 which engages the lower side of the flange 72 at its upper end and extends downwardly to engage at its lower end with the outer race 75 of a ball bearing 76 positioned slidably inside of the housing 70, being adapted to engage the upper end 78 of the sleeve 64 to act as a stop, and urged thereagainst by the spring 74. If desired, the outer race member 75 of the ball bearing may be provided with antifriction means 80 to facilitate the sliding relation with the housing 70. The inner race member 82 of the ball bearing is adapted to cooperate with and journal a sleeve 84, which is fitted concentrically about the non-rotative driving member or staff 46 and adapted to cooperate therewith by a nut 86 fixedly attached to the upper end of the sleeve to form a threaded relation therebetween whereby the sleeve when rotated about the driving member will be enabled to move the driving member or staff 46 in a desired direction. The sleeve 84 has positioned about it a second smaller helical spring 88 nested within the spring 74, contacting at its lower end the inner race member 82 of the ball bearing and contacting at its upper end a washer 90 adapted to bear against a spring ring 92 fitted into an annular slot 94 of the sleeve to form an anchor or stop. At the lower end of the spring 88, the inner race member 82 of the ball bearing is urged against a stop on the sleeve 84 comprising a spring washer 96 positioned in a slot 98 in the sleeve and having a washer 100 therebetween.

The sleeve 84 extends below the slot 98 where it cooperates with a felt grease ring 102 which snugly embraces the sleeve to prevent egress of grease from the housing 70 and the ingress of foreign matter through the opening 104 of the sleeve 64. The ring 102 is held by gravity against an internal shoulder 106 of the sleeve 64.

Above the spring ring 92 positioned in the annular slot 94 of the sleeve 84, a spacer ring 108 is positioned to retain in position a self-energizing spring clutch member 110 positioned about the sleeve 84. Movement of the clutch member 110 in an upward direction is prevented by spring ring 112 positioned in annular slot 114 in the sleeve, a washer 116 being positioned between the ring and the clutch member.

The self-energizing spring clutch member 110 comprises a number of turns of spring steel in helical form, preferably wound (left-hand) in counterclockwise relation downwardly, looking from the upper end of Fig. V (all rotative relations are given hereinafter from this point of view) with the adjacent turns in touching relation and having a generally rectangular cross-section in any one of the turns. The ends of the

spring are bent outwardly to form upper and lower tabs 118 and 120 respectively, spaced circumferentially approximately 180° from each other, which cooperate with driving means to be described hereinafter. The internal dimension of the clutch member 110 is such that when in position on the sleeve 84 certain of the turns such as, the middle turns or preferably the end turns of the member must provide a frictional engagement with the sleeve. This frictional engagement of the turns gives purchase to the clutching action of the spring clutch member when an actuating force is applied to either tab thereof in a winding or tightening operation so that the clutch will be self-energized to grip the sleeve and drive the sleeve in the desired direction. When a force is applied to either tab in an unwinding or loosening direction, this frictional engagement will be eased and a slipping will be attained for a de-clutching action. A clutching action can thereby be attained by applying a winding or tightening force to the tabs 118 and 120 on the ends of the clutch member, or a de-clutching action by the application of an unwinding or loosening force to either of the tabs. A means will now be described whereby these forces can selectively be applied to the tabs, or spring projecting means 118 and 120.

The tabs or spring projecting means 118 and 120 preferably extending radially outwardly, as shown in Fig. V, are adapted to engage with a spring energizing member 122 preferably in the nature of an inwardly extending lug mounted on a rotatable longitudinally-shiftable sleeve 124, encircling in spaced concentric relation the spring clutch member 110, and the sleeve 84 on which the spring clutch member is mounted. The spring energizing member or lug 122 extends radially inwardly into the annular space between the interior of the sleeve 124 and the exterior of the spring clutch member 110, having a clearance with the latter to prevent engagement with the body of the clutch member, being adapted however to engage with the tabs 118 and 120 as the sleeve 124 mounting the lug 122 rotates in concentric relation about the clutch member 110. The longitudinal dimension of the lug 122 having reference to the threaded staff 46, is such that it will always just engage one of the tabs 118 or 120 and will not pass at any time between them in their longitudinal spacing when rotated or subject to relative rotation with reference to the lug 122. In other words, no matter whether the lug 122 is being rotated with reference to the tabs 118 and 120, or the tabs 118 and 120 are being rotated relative to the lug 122, or both are being rotated in opposite directions, contactual relation between the lug 122 will be obtained with either tab 118 or 120 depending upon the longitudinal position of the shiftable mounting sleeve 124 for the lug. The transverse dimension of the lug 122 is relatively small and is related largely to strength and rigidity, but must allow relatively large circular or rotative movement of the lug before engaging the opposite sides of the tabs 118 and 120, which establishes a winding or tightening engagement or an unwinding or loosening engagement with either of the tabs, depending upon the side of the tab engaged by the lug.

To rotate the sleeve 124 and the lug 122 carried thereby concentrically about the spring clutch member 110 in either clockwise or counterclockwise direction so as to engage the lug 122 with the spring tabs 118 and 120, as already described, the

sleeve 124 is mounted slidably within a second sleeve 126, which is attached to the lower side of a drive pulley 128 journaled on the sleeve 84 adjacent the upper end of the housing 70 and driven by a motor device, as will be described in further detail hereinafter. The rotation of the pulley 128 rotates the second sleeve 126 fixedly attached to the pulley by riveted studs 130, the second sleeve 126 in turn rotating sleeve 124 through the agency of a pin and slot arrangement, including a pin 132 mounted by riveting on the interior of the second sleeve 126, which engages an oblique slot 134 in the wall of the sleeve 124, preferably located approximately 130° from the position of the lug 122. The turning moment is transferred from the second sleeve 126 to the sleeve 124 through the cooperative relation between the pin 132 and the oblique slot 134 of the sleeve 124, which creates a vertical component of the moment due to the oblique conformation of the slot 134 which slides the sleeve 124 longitudinally with reference to the second sleeve 126, and thereby moves the lug 122 longitudinally with reference to the tabs 118 and 120 of the spring clutch member 110 to engage one or the other depending upon conditions.

There is a relation between the left-handed thread of the staff 46, the counterclockwise winding (top Fig. V) of the spring clutch member 110 and the obliqueness of the slot 134, which ascends in a counterclockwise direction in the wall of the sleeve 124 at an angle approximately 45° (top Fig. V) or, in other words, the sleeve 124 is thrust downwardly when the pin 132 is rotated counterclockwise (top Fig. V) by the sleeve 126, and sleeve 124 is thrust upwardly when the pin 132 is rotated clockwise by its supporting sleeve 126. Downward thrust of the sleeve 124 moves the lug 122 correspondingly so that it will engage the lower tab 120 of the spring clutch member 110. Upward thrust of the sleeve 124 moves the lug 122 correspondingly so as to disengage the lower tab 120 and engage the upper tab 118.

The engaging relation between the tabs 118 and 120 of the spring clutch member 110 and the lug 122 of the sleeve 124 is further influenced by the displacement of the sleeve 84, which displaces simultaneously the clutch member 110 longitudinally in its space relation with the lug 122. The longitudinal displacement of the sleeve 84 is brought about by its threaded relation through the agency of nut 86 with the threaded staff 46 nonrotatively attached at its upper end to the window glass 18 as already described and shown in Fig. I.

When the resistance to downward movement of the glass 18, as provided by a stop 174 on the frame member 14, approaches a predetermined value, say 60 pounds, the rotation of the nut 86 creates an upward pull on the sleeve 84 by climbing up the fixedly held threaded staff 46 to displace the sleeve 84 upwardly which by the stop 96 depresses and deflects from neutral position the outer spring 74 against its anchor, the internal flange 72 of the housing 70, to create a preloading on the staff 46. The upward movement of the sleeve 84 also moves upwardly simultaneously the spring clutch member 110 with its terminating tabs 118 and 120, to effect their driving relation with the lug 122 as will be described further hereinafter. In the same manner, when the upward movement of the glass 18 and the staff 46 is stopped by the frame 16 of the door, the resistance to further movement will rapidly approach a predetermined value, say 40 pounds (taking into consideration the effect of gravity), 75

which will move the sleeve 84 downwardly by the nut 86 climbing down the staff 46 which causes a deflection or depression from neutral position of the inner spring 88, applied by the sleeve 84 to the spring 88 by stop 92, the spring 88 being anchored through the ball bearing 76 against the upper end 78 of the sleeve 64. This downward movement of the sleeve 84 simultaneously moves the spring clutch member 110 with its tabs 118 and 120 downwardly to effect again its driving relation with the lug 122. This interplay of movements of these parts will be described in further detail hereinafter.

The pulley 128, which is journaled on the sleeve 84 to allow longitudinal movement of the sleeve but does not move longitudinally therewith, is held in fixed relation with the housing 70 by a shoulder 136 on the pulley 128 which rotatively contacts the upper end 138 of the housing by its lower side with an antifriction member 139 therebetween and engages on its upper side with a bearing 140 slidably journaled the sleeve 84 at its upper end adjacent the nut 86. The bearing 140 is housed in a bracket 142 which is held in fixed relation to the housing 70 by extensions 144 fitting against laterally extending flanges 146 and 147 of the housing and held thereagainst by screws 148 and 150. Screw 150 also attaches a bracket 152 to the flange 147 which supports a housing 154 by screw 155 through which the threaded staff 46 and the nut 86 of the sleeve 84 extend, the nut 86 cooperating with a felt washer 156 retained in position in housing 158 to snugly fit against the periphery of the nut 86 to prevent ingress of foreign matter into the housing.

The housing 154 protects the driving arrangement for the pulley 128 from exposure to the weather. The driving arrangement consists preferably of a toothed belt 160 cooperating with the toothed periphery of the pulley 128 and the toothed driver pulley 162 mounted on the armature shaft 164 of a reversible electric motor 166, which is mounted by any convenient means (not shown) to the flange 147 of the housing 70 in a manner so that the shaft 164 is vertical to place the driver pulley 162 in a plane with the driven pulley 128 so that the belt can effectively create a driving relation therebetween. It may be desirable to have a speed reduction from the driver pulley 162 to the driven pulley 128 as shown. The housing 154 covers all of the parts as shown.

Referring to Fig. I, the leads 168 of the electric motor 166 are connected to a manually-operated reversing switch 170 mounted on the door frame 14 to be conveniently actuated from the interior of the car, so that control over the motor is readily attained. Thereafter leads 172 are connected to a source of power (not shown) of the automotive vehicle. These details are well known in the art.

The device operates as follows: Assuming that the window glass 18 is in the position shown in Fig. I and the operator of the automotive vehicle desires to raise the glass so as to close the window, upward movement of the staff 46 will be required to move the glass 18, and inasmuch as the staff 46 is provided with left-handed threads, the sleeve 84 and its nut 86 must be rotated counterclockwise, (top Fig. V) to bring this about. The electric motor will be operated in a direction to rotate the pulley 128, its attached sleeve 126, and the slidable sleeve 124 in a counterclockwise direction. The counterclockwise rotation of these parts will move the pin 132 to the upper end of the oblique slot 134 which will thrust the

sleeve 124 to its lowermost position which (assuming that the springs 74 and 88 are in neutral position) will move downwardly simultaneously the lug 122 on the sleeve 124 so that it will contact the forward face of the lower tab 120 to place a winding or tightening force on the end of the spring clutch member 110. The frictional engagement of some of the turns of the spring clutch member 110, with the exterior of the sleeve 84, gives purchase to the winding or tightening force applied by the lug 122 to the tab 120, which will self-energize the spring to become a clutch member engaging the exterior of the sleeve 84 to rotate it in a counterclockwise direction to raise the staff 46 and thereby raise the window glass 18. This operative clutching relation between the spring clutch member 110 and the sleeve 84 will continue either until the window is completely closed which will give rise to a reaction force acting on the spring 88 or a reaction force arises from some other reason, such as blocking over the predetermined limit of say 40 pounds. When the window glass 18 is completely closed, this reaction force is attained and automatically changes the driving relations of the elements, as will now be described.

As soon as a reaction force of the predetermined value is attained, as determined by the strength and stiffness of spring 88 (when movement of the glass 18 is upward), a downward movement of the sleeve 84 is caused with a deflection of the spring 88 carrying with it the spring clutch member 110 whose movement on the sleeve 84 is limited by stops 92 and 112, compressing the spring 88 against the end 78 of the sleeve 64, the compressing force being transmitted by stop 92. The downward movement of the sleeve 84 is caused by the stopping of the window glass 18 which causes the nut 86 to pull the sleeve 84 downwardly inasmuch as the staff 46 becomes stationary by the stoppage of the glass, the driving moment still being applied by the lug 122 to the tab 120. The downward movement of the sleeve 84 and the spring clutch member 110 frees the tab 120 from the lug 122 by slipping past its lower end to break the driving relation therebetween, the lug 122 being stationary longitudinally inasmuch as the pin 132 is in the top end of the oblique slot 134. The rotation of the sleeve 124 in the counterclockwise direction continues after the lug 122 is freed from contact with the tab 120 for approximately 180°, at which time the upper end of the lug 122 contacts the upper tab 118 and moves it in a counterclockwise direction, which in this instance is an unwinding or loosening action so that no further clutching but rather a de-clutching occurs, allowing the driving elements to operate freely in the counterclockwise direction, with the sleeve 84 and the staff 46 stationary, subject however to the upward urge of the deflected spring 88 giving the predetermined bias or preloading on the window glass 18.

If the window glass 18 is closed, the motor and its driving elements can be energized at the will of the operator in a counterclockwise direction as long as he desires and the motor will not be substantially loaded and cannot burn out, and there will be no change in the conditions in the drive mechanism. However, when the motor is reversed and the pulley 128 is driven in a clockwise direction, a new phase of the operational cycle is entered and will now be described.

With the termination of the driving in a counterclockwise direction with the window glass

18 in closed position, the pin 132 is in the upper end of the oblique slot 134, with the lug 122 contacting the upper tab 118 of the spring clutch member 110, for the application of a driving moment in an unwinding or loosening relation, and at the same time the spring 88 is compressed and applying its predetermined bias or preloading to hold the window glass 18 firmly against the upper side of its frame, which also has displaced the sleeve 84 to its lowermost position and with it the spring clutch member 110. Now when the pulley 128 has its direction of rotation reversed by reversing the electric motor by the manual switch 170, the first action of the device may be the shifting of the pin 132 from the upper end of the oblique slot 134 to the lower end thereof, which creates a longitudinal movement upwardly of the sleeve 124 to also move upwardly the lug 122, which may then rotate approximately 360° before it again contacts the upper tab 118 on its opposite side to apply a driving torque in the winding or tightening direction, which with the purchase created by the frictional engagement of some of the turns of the spring clutch member 110, immediately clutches the sleeve 84 and drives it in a clockwise direction (top Fig. V).

It will be noted that the electric motor 166 is given by the mechanism described a period of free running allowed by the free rotation of the sleeve 124 through at least 360° or more before it must pick up, at least in part, the operating load after the spring 110 has clutched the sleeve 84. This gives the motor an opportunity to build up kinetic energy to get a "running start" on the static load which is due to the compression of the spring 88 by the preloading on the window glass 18 and the inertia of the parts. The kinetic energy of the moving parts aids the motor in its starting operation so that it need not depend only upon its starting torque. Once movement occurs, the deflected spring 88 aids the motor to some extent by being itself unloaded by upward movement of the sleeve 84 and brought to normal neutral condition before the full load is carried by the motor by moving the window glass. The electric motor is given thereby a period of no load and light load in which to pick up speed before the full load is picked up by the driving mechanism and placed on the motor.

As pointed out above, after the lug 122 picks up the opposite side of the tab 118 by clockwise rotation and creates a new clutching relation between the spring clutch member 110 and the sleeve 84, the sleeve 84 is first moved upwardly to relieve the loaded condition of the inner spring 88 until neutral position is attained between inner spring 88 and outer spring 74. When neutral position is attained, the sleeve 84, by its clockwise rotation through the nut 86, will move the staff 46 downwardly to lower the window glass 18 and open the same. The upward movement of the sleeve 84 and the clutch spring 110 will not break the clockwise driving relation (tightening) between the lug 122 and the upper tab 118, but will only move the tab 118 nearer to the upper end of the lug 122 preparatory to being disengaged when the movement of the window glass 18 reaches its lower limit as will now be described.

Once having established the clockwise driving relation to rotate the sleeve 84 in a clockwise direction and to move the staff 46 downwardly by its left-handed thread cooperating with nut 86 on

the sleeve 84, the downward movement will continue until the lower limit of travel of the window is reached, as determined by the stop 174 (Fig. I). Here the travel of the window is stopped and the preloading force is again built up in the driving mechanism by moving the sleeve 84 upwardly from neutral position by having the nut 86 climb up the non-rotative staff 46 which is held stationary by the stop 174. This movement of the sleeve 84 deflects the outer spring 74 upwardly by stop 96 to compress it against its anchor, the inner flange 72 of the housing 70. The sleeve 124 being held in fixed longitudinal relation by having the pin 132 in the bottom end of the oblique slot 134 holds the lug 122 in the same fixed relation, so that upward movement of the sleeve 84 and the clutch spring member 110 with its end tabs 118 and 120, frees the upper tab 118 from its driving relation with the lug 122 by slipping over its upper end, so that the lug 122 may rotate 180° approximately to establish a clockwise relation with the lower tab 120, which is in the unwinding or loosening direction to declutch the clutch spring member 110 from its driving relation with the sleeve 84 to allow slippage and relatively free rotation therebetween. This declutching removes the full load from the motor 166 and allows it to run under relatively light load as already described with reference to the upper limit of movement of the window glass 18. This leaves the window glass positioned against the stop 174 with a preloading as determined by the deflected spring 74 as described. This preloading of the window glass 18 at the extremes of its movement prevents rattling due to looseness, etc.

Now, if the operator again reverses the rotation of the motor 166 by the reversing switch 170, the motor is again provided with a free running period before picking up full load as described with reference to the first reversal of the motor. With the sleeve 124 again rotating in a counterclockwise direction (top Fig. V), the pin 132 is again moved to the upper end of the oblique slot 134 moving lug 122 downwardly and the lug 122 after rotating through approximately 360 degrees again contacts the lower tab 120 on its opposite side to establish a winding or clutching relation with the sleeve 84 by the spring clutch member 110. This will first unload the outer spring 74 to neutral position by downward movement of sleeve 84 and then pick up full load to move the glass 18 upwardly again as already described.

The window glass 18 may be stopped at any intermediate position between the limit positions during movement in either direction by merely deenergizing the motor 166 by the manual switch 170. This will leave the springs 74 and 88 in neutral position. Movement in either direction of the glass 18 can be readily attained by rotating the sleeve 124 by the motor 166 clockwise for downward movement of the glass, and counterclockwise for upward movement thereof. The elements of the clutching and declutching means will automatically assume the essential driving relations as already described, except that the unloading of the springs 74 and 88 will not occur at any of the intermediate positions of the glass.

Referring now to Fig. VII, a modification of the invention is shown wherein the equivalent of the spring-energizing member or lug 122, as shown in Fig. V, is mounted on the sleeve 84 and may consist of a lug 130 affixed to the sleeve 84 by welding or the like and adapted to shift longitudinally therewith. The lug 130 is adapted to co-operate with upper and lower, internally-extending

ing end tabs 182 and 184 respectively (displaced circumferentially approximately 180 degrees) of a self-energizing spring clutch member 186 wound clockwise (top Fig. VII) downwardly, positioned on the interior of a longitudinally shiftable sleeve 188, wherein it is held by a pair of stops 190 and 192 affixed in inner annular grooves 194 of the sleeve 188. The spring clutch member 186 in this modification as adapted to establish by its exterior surface a clutching and declutching relation with the interior surface of the shiftable sleeve 188, and is provided with a frictional engagement therewith by certain of its middle or end turns, as already described in the first modification, in order to give purchase to the clutching action of the element. The dimensional relation between the internally-extending tabs 182 and 184 is the same as in the modification already described.

The longitudinally-shiftable sleeve is mounted inside of a second outer sleeve 196, mounted on a pulley 198 for rotation therewith. The sleeve 196 is provided with a pin 200 mounted fixedly on its inner surface, where it extends into an oblique slot 202 positioned in the wall of the sleeve 188, so that when driving torque is applied to the sleeve 188, through the agency of the pin 200 and slot 202 by the outer sleeve 196, the sleeve 188 will be shifted longitudinally in accordance with the direction of rotation of the outer sleeve. When the rotation is counterclockwise (top Fig. VII) the pin 200 will move to the top end of the slot 202 and when the rotation is clockwise the pin 200 will move to the bottom of the slot 202. Viewing the sleeve 188 alone, the slot 202 is ascending at an angle of approximately 45 degrees in a counterclockwise direction. The pin 200 does not pierce the inner surface of the sleeve 188 to interfere with the action of the clutch member 186. In other respects the construction of the actuating mechanism is the same as in the modification described.

This modification operates as follows: With the staff 46 provided with a left handed thread in the same manner as in the first modification, when the sleeve 84 is rotated counterclockwise, the staff 46 will move upwardly, with the driving relation being established with the pin 200 in the top end of the slot 202 so as to position the shiftable sleeve 188 in its lowermost position. With the springs 74 and 88 in neutral positions, the upper tab 182 will contact the lug 130 on the sleeve 84, and create an expanding or tightening condition within the spring clutch member 186, and due to the purchase derived from the frictional engagement of certain of the turns thereof with the inner side of the sleeve 188, a clutching action will arise to allow the upper tab 182 to drive the lug 130 in a counterclockwise direction to advance the staff 46 upwardly to raise the window.

When the upper limiting position is reached the sleeve 84 will move downwardly to compress inner spring 88 to create the desired preloaded condition as described earlier with reference to the first modification, which will cause lug 130 to move downwardly with tabs 182 and 184 remaining longitudinally stationary, so that upper tab 182 will slip off the upper end of the lug 130 to free it, then after 180° of relative counterclockwise rotation, lug 130 will be engaged by the lower tab 184 to create a contracting or loosening condition within the spring clutch member 186 to cause a declutching action between it and the sleeve 188.

Taking into consideration the change in operation arising from the reversal of the position of

lug 180 and the self-energizing spring clutch member 186, the modification shown in Fig. VII performs the same function in substantially the same manner as the modification shown in Fig. V.

With the reversal of rotation of the sleeve 188 to clockwise rotation, the pin 200 will move to the lower end of the slot 202 to move the sleeve 188 to its uppermost position and with 360 degrees rotation causes engagement between lug 180 and the lower tab 184 on the opposite side of the lug to create the expanding or tightening relation for a clutching action to drive the staff 46 downwardly. First the spring 88 will be unloaded with upward movement of the sleeve 84 and then full load will be assumed by the motor to move the staff 46 till the lower limit of movement is reached. The sleeve 84 will then climb up the staff 46 to load spring 74 and displace lug 180 upwardly to disengage it from the lower tab 184 and break the clutching relation. The clutching member 186 after rotating 180° clockwise will pick up by the upper tab 182 the lug 180 and cause a contracting or loosening relation to be established which will declutch and allow the motor 166 to run relatively under light load.

As with the first modification, the interviewing positions of the glass 18 can be attained by stopping the motor when the window glass 18 is at the desired position.

With reversal of the motor again to rotate sleeve 188 in counterclockwise direction, the pin 200 moves again to the upper end of the slot 202, and the initial movement will first unload the spring 74 by downward movement of the sleeve 84. With the springs 74 and 88 in neutral position, the full load will be taken up by the motor for upward movement of the window 18.

It is to be understood that the motor 166 in this modification also has the short free running period of practically no load or light load before full load is taken up with "a running start," all as is described with reference to the first modification.

It is to be understood that the above detailed description of the present invention is intended to disclose an embodiment thereof to those skilled in the art, but that the invention is not to be construed as limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of being practiced and carried out in various ways without departing from the spirit of the invention. The language used in the specification relating to the operation and function of the elements of the invention is employed for purposes of description and not of limitation, and it is not intended to limit the scope of the following claims beyond the requirements of the prior art.

What is claimed:

1. A window actuating mechanism comprising a reversible electric motor, a threaded sleeve, a coupling between the sleeve and the electric motor including friction means for clutching a surface carried by said sleeve and control means therefor functioning in response to the direction of rotation of the motor for establishing its drive in either direction, a non-rotatable screw shaft threaded in said sleeve for causing the shaft to move longitudinally with respect thereto in response to rotation of said sleeve for moving a window between selected positions, the sleeve being axially displaceable with respect to the electric motor to provide a longitudinally sliding movement between said friction means and said

control means when the resistance to the longitudinal movement of the screw shaft for moving the window exceeds a predetermined value to uncouple the sleeve from the electric motor to thereby interrupt the movement of said window.

2. A window actuating mechanism comprising power actuated means, a member for moving the window to and from selected positions, coupling means for establishing a driving connection between the power actuated means and the window moving member, including a self-actuating clutch carried by said member and energizing means for said clutch carried by the power actuating means for rotary movement therewith and axial displacement to spaced positions in response to its direction of rotation a longitudinally slidable element operable to uncouple said driving connection, a spring preloaded to a predetermined value connected to said window moving member for opposing the longitudinal sliding movement of said element whereby when the resistance to the movement of said window reaches the preloading value of said spring the uncoupling of the power actuated means and window moving member takes place by relative longitudinal movement between said clutch and its energizing means and the window is held in position under the preloaded value of said spring.

3. A window actuating mechanism comprising a prime mover for operating a driving member, a sleeve spring preloaded against load reaction operable to move a window to and from a selected position, a clutch operating as a driving connection between said driving member and spring preloaded sleeve, said clutch including friction means carried by said sleeve operated by an energizing member having a connection with the driving member for limited rotary and axial displacement with respect to the friction means in response to the direction of rotation of the driving member means longitudinally movable with the spring preloaded sleeve rendered operable by load reaction when the window reaches the ends of its allowable movement to interrupt said driving connection by disconnecting said clutch by relative longitudinal movement between said friction means and its energizing member whereby the window is held tight in such position under the spring preload even when the motor is disconnected.

4. A window actuating mechanism comprising an electric motor, a stationary housing, a sleeve supported in said housing rotary and forwardly or rearwardly sliding movement relative said motor, load sensitive spring means preset to a predetermined value and being connected to the sleeve and housing for opposing the sliding movement of said sleeve, a coupling between said sleeve and motor whereby the said sleeve is driven by the electric motor, a member for moving a window panel from one selected position to another, a helical connection between said sleeve and said window moving member operable to cause said member to move longitudinally relative thereto in response to rotation of said sleeve, the load-sensitive spring means permitting the longitudinal sliding movement in a forward or rearward direction of said sleeve relative to the electric motor in response to a predetermined selected resistance to the movement of said window panel for uncoupling the sleeve and motor causing the motor to run essentially under no load and stop the movement of said window panel.

5. A window actuating mechanism comprising a reversible electric motor, a supporting housing, a rotatable nut resiliently held in a stationary position in said housing against upper or downward movement, a coupling between said nut and the electric motor located in said housing for rotating the nut in either direction, a non-rotatable screw shaft threaded in said nut and adapted to be moved longitudinally with respect thereto in response to the rotation of said nut for moving a window pane to and from a closed position, resilient means preset to a predetermined value carried by said housing and connected to said nut for opposing its upper or downward movement, the nut and said resilient means being operable when resistance to the movement of the window pane exceeds different predetermined values for either directions to allow the upper or downward movement of the nut out of said stationary position to uncouple the nut from the electric motor and thereby interrupt further movement of said window pane.

6. A window actuating mechanism comprising a driving member rotatable in opposite directions, a sleeve member operated thereby for causing the movement of window pane to and from closed position, a coil spring having convolutions in a slight frictional engagement with one of said members and operable for self clutching engagement therewith, energizing means rotatable by the other of said members for engaging either end of said coil spring to produce the spring self clutching engagement, axially displaceable means connected to the driving member responsive to the direction of rotation of the driving member operable to produce the engagement of the energizing means with the end of said spring which causes the self clutching engagement thereof effecting thereby a positive driving connection between said members irrespective of the direction of rotation of the driving member, and longitudinally yielding means operable when the resistance to the movement of the window pane exceeds a predetermined amount while the spring is clutchingly engaged with said member to produce longitudinal relative movement between said spring and energizing means for interrupting the self clutching engagement of said spring stopping the operation of the sleeve member by the driving member to thereby interrupt the movement of the window pane.

7. A closure actuating mechanism comprising a driving member operable in either direction for rotating a sleeve having a threaded connection with a non-rotatable member adapted to move longitudinally a closure to and from closed position, a clutch surface provided on the outer surface of said sleeve, a coil spring mounted for clutching engagement with said surface and provided with projecting means adjacent each end portion, an energizing element rotatable by the driving member adapted to engage said spring projecting means, and means responsive to the direction of operation of the driving member including an inclined slot and pin connection to cause longitudinal movement of said energizing element with respect to said coil spring whereby said element engages the spring projecting means which produces self clutching engagement of the spring with said clutch surface to thereby effect a driving connection between said sleeve and driving member irrespective of the direction of operation of the driving member to move said closure to and from closed position.

8. A window actuating mechanism comprising an electric motor, a member connected to a window for moving the window to and from selected positions, means for establishing a driving connection between the electric motor and the window moving member providing a free running period for said motor, said means including a member connected to said motor and being axially displaceable in response to the direction of rotation of the motor, a longitudinally slidable element forming a part of said driving connection, and a resilient member loaded to a predetermined value for opposing the longitudinal sliding movement of said element, the longitudinal slidable element and resilient member being so interconnected that when the resistance to the movement of said window by the window moving member reaches the preloading value of said resilient member the slidable element moves longitudinally and the driving connection of the electric motor and window moving member is interrupted by the longitudinal movement of said element and the window is held in position under such preloaded value and the electric motor runs essentially under no load.

9. A window actuating mechanism including a driving member and a driven member the latter operable for moving the window between selected positions, one of said members having a clutch engaging surface, a clutch spring normally out of clutching engagement with said surface, energizing means operated by the driving member and movable axially in response to the direction of rotation of the driving member into energizing engagement with the spring for causing the spring clutchingly to engage said surface, load-sensitive means connected with the driven member yieldingly to permit relative longitudinal movement between said members upon imposition of overload while the spring is clutchingly engaged with said surface, and means actuated upon predetermined longitudinal movement between said members to effect relative movement between said clutch spring and said energizing means to cause disengagement of the spring clutch with said clutch engaging surface.

10. A window actuating mechanism including a reversible driving member and an output member the latter operable for moving the window between selected positions, one of said members having a clutch engaging surface, a clutch spring having freely projecting ends and slight frictional engagement but normally out of clutching engagement with said surface, energizing means for said clutch spring operating solely on either of the projecting ends thereof, a helical connection between the other of said members and said energizing means, said helical connection being operable by the direction of rotation of the connected member therewith for moving the energizing means into energizing engagement with the proper end of the clutch spring for causing the clutch spring to clutchingly engage said surface, yielding means responsive to load reaction connected with the output member to permit longitudinal movement between said members upon the imposition of overload while the spring is clutchingly engaged with said surface, and means actuated upon predetermined degree of longitudinal movement between said members to effect relative movement between said clutch spring and said energizing means to cause disengagement of the clutch spring with said clutch engaging surface.

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11. A window actuating mechanism including a power supplying member and a second member actuated thereby for operating a window the power supplying member having a clutch engaging surface, a clutch spring mounted for rotation with the power supplying member and normally out of clutching engagement with said surface, energizing means for the spring carried by said second member and movable to active and inactive positions, means arranged yieldingly to permit relative longitudinal movement of said members upon imposition of overload while the spring is clutchingly engaged with said surface, said means cooperating with the energizing means for moving the same to inactive position upon a predetermined degree of relative longitudinal movement of said members, to release the spring from clutching engagement whereby the power supplying member runs essentially under no load.

12. A window actuating mechanism comprising a member spring preloaded against load reaction adapted to be operably connected to be driven by a power supplying member for actuating a window to and from selected positions, energizable coupling means interposed between the power supplying and preloaded member operable to establish a driving connection between said members, said coupling means including friction clutching means connected to the driving member axially displaceable in response to its direction of rotation and a longitudinally shiftable element for uncoupling the members by stopping the energization of the coupling means, means operable by movement of the spring preloaded member caused by the load reaction produced by a predetermined selected resistance while actuating said window to shift longitudinally said element for uncoupling the spring preloaded member from the power supplying member, and the spring preloaded member operating when the

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uncoupling takes place to hold the window in position under such spring preload irrespective of when the power supplying member is stopped.

13. A window operating mechanism comprising a rotatable reversible driving member and a sleeve the latter rotatable in either direction by the driving member for causing the movement of a window to and from selected positions, a clutch spring having freely projecting ends and wound with convolutions adapted to be in a slight frictional engagement with said sleeve but normally out of clutching engagement therewith, an energizing member normally in engagement with either end of said clutch spring rotatable with the driving member and axially displaceable with respect thereto in response to its direction of rotation to actuate the spring clutch by engaging the proper projecting end thereof to energize the spring convolutions to clutchingly engage said sleeve establishing a driving connection between the driving member and the sleeve irrespective of the direction of rotation of the driving member to cause the movement of the window to and from selected positions.

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